Cover Page

- **Project Title:** Klamath Falls Targeted Airshed Program

- Applicant Information:
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- **Budget Summary:**

EPA Funding Requested	Voluntary Cost Share, if Applicable	Total Project Cost
$ 16,901,238	$ 0	$ 16,901,238

- **Project Period:** September 1, 2020 to August 31, 2025 (5-year period)

- **Brief Project Description:** The Oregon Department of Environmental Quality (DEQ) will partner with Klamath County Public Health (KCPH) to deliver a comprehensive program that permanently reduces emissions from the major sectors contributing to $PM_{2.5}$ emissions in the Klamath Falls nonattainment area: residential wood combustion and on-road sources. The primary strategy of this proposal builds and improves upon long-standing and robust woodstove changeout programs in the area by converting wood-burning residential heating devices to non-wood burning devices such as gas inserts and ductless heat pumps. This effort will be coupled with weatherization efforts to maximize heating efficiency and reduced costs for residents, ongoing education and outreach efforts, and a community firewood program so that those who continue to burn wood as a main source of heat have access to seasoned firewood.

  Dedicated strategic program coordination and management between DEQ and KCPH will ensure continued benefits from appropriate management of prescribed burning emissions impacts on human health, and a household heating survey will build upon previous rounds of intensive household heating surveys, document shifts in the emissions inventory of heating devices used in the nonattainment area, and inform evaluation efforts that will guide future strategies and programs. Finally, diesel school bus changeouts to propane for three school districts in the nonattainment area and a feasibility study will address on-road source emissions that will inform future upgrades to public transportation buses.

- **Project Location:** Klamath Falls, Oregon Nonattainment Area

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Section 1 - Project Summary and Approach

A. Ongoing, Significant Emissions Reductions & Consideration of Other Activities

Detailed Project Summary

According to Environmental Protection Agency (EPA), Klamath Falls, Oregon had the highest recorded 24-hour levels of fine particulate matter ($PM_{2.5}$) in the United States. The 2016-2018 24-hour design value was 75 µg/ m^3, over 200% above the 2006 24-hour National Ambient Air Quality Standard, of 35 µg/ m^3.The challenge of identifying, funding, and implementing the controls needed to produce the reductions required to attain and maintain the ambient $PM_{2.5}$ standard requires a multi-pronged, multi-sector strategy.

Klamath County is a rural community set in the high desert of southern Oregon. Geographically larger than the state of Connecticut, Klamath County is home to an estimated 67,653 people.[1] Klamath Falls is the largest city with approximately 20,840 people. The urban growth boundary (UGB), which is the central hub of activities and services for south central Oregon and northern California, includes Klamath Falls, surrounding cities, and unincorporated areas. In 2015, the total population of the UGB was estimated at 43,093 people.[2] The hills and elongated ridges surrounding the city result in a basin that experiences very strong and shallow nighttime inversions. This is especially pronounced during cold winter months, when residents often use wood stoves.

Since December 2008, Klamath Falls has been designated a "nonattainment" area for $PM_{2.5}$ by the EPA, with wood burning fireplaces and stoves estimated to contribute 44% of worst case day $PM_{2.5}$ emissions. Over the years, Oregon Department of

[1] U.S. Census Bureau QuickFacts for Klamath County, Oregon. https://www.census.gov/quickfacts/fact/table/klamathcountyoregon/PST045218 (Accessed 1/28/2020)

[2] Ruan, Xiaomin, R. Proehl, J. Jurjevich, K. Rancik, J. Kessi, C. Gorecki, and D. Tetrick, "Coordinated Population Forecast for Klamath County, its Urban Growth Boundaries (UGB), and Area Outside UGBs 2015- 2065." Portland State University Population Research Center, June 2015.

Environmental Quality (DEQ) has partnered with Klamath County Public Health (KCPH), other government agencies, and local organizations to work towards attainment. Millions of State and Federal dollars and thousands of hours have been invested to reduce $PM_{2.5}$ and improve air quality in the community through a combination of wood stove change out programs, regulatory restrictions, public notification efforts, increased community engagement and outreach, and curtailment enforcement. Since 2013, Klamath has worked diligently to meet the 3-year 24-hour $PM_{2.5}$ rolling averages of 35 μg/ m^3, but the work is not complete.

This application seeks funding to (1) expand programs to achieve permanent, deep $PM_{2.5}$ reductions from residential wood combustion, (2) quantitatively document the impacts of that work, and (3) realize additional, innovative reductions in sectors not previously addressed. In so doing, DEQ and KCPH will be partnering to realize a significant shift in fuel sources for residential heating in the nonattainment area and nearby adjacent areas, augment and update existing data about the community that quantifies the impacts of change outs to strategically inform future efforts, increase outreach and education, improve upon on a community firewood program, and explore public transportation renewable energy options in the County. These actions will help achieve this project's goal to decrease and sustain the 24-hour $PM_{2.5}$ count to below 30 μg/ m^3.

Methodology for selecting sectors to address and reduction strategies

As the 2017 emissions inventory for the Klamath Falls Nonattainment Area in Section 2 shows, there has been an overall decrease in the total amount of $PM_{2.5}$ emissions in the nonattainment area since 2008 and 2014 (see Attachment 1, Emissions Inventory). Residential wood combustion is the largest single contributing source category to $PM_{2.5}$ emissions in the inventory, especially on typical season days or worst case days. The greatest decreases observed in this period are in the Area or Nonpoint Sources category, and the On-road category. The 2017 inventory also shows an increase in $PM_{2.5}$ coming from point sources, due to an increase in industrial source activity since the economic depression in 2008 and the addition of one stationary source. The increase observed in the non-road sector in 2017 is due to the addition of an airport, and rail activity.

Based on the emissions inventory, DEQ chose the following strategies. Strategy 1, "Achieving permanent, deep emissions reductions from residential wood combustion," addresses residential wood combustion. Strategy 2 addresses emissions from prescribed burning and maintains reductions in the point source inventory, and includes an innovative, targeted school-based education and outreach component, while Strategy 3 attempts to specifically address on-road emissions by increasing the adoption rate of cleaner burning mobile vehicles in ways that are targeted towards increasing benefits in the nonattainment area.

Strategy 1. Achieving deep, permanent emissions reductions from residential wood combustion.

Strategy 1 involves multiple components to maximize reductions in residential wood combustion: (A) an enhanced wood stove change out and weatherization program; (B) a community firewood program; and (C) an expanded community outreach and education program, including enhanced air quality monitoring at local schools.

Wood stove change out and weatherization (WCOW)

DEQ and KCPH will contract with a local organization, South Central Oregon Economic Development District (SCOEDD), with a long history of successfully administering and implementing a woodstove change out and weatherization (WCOW) program. Through WCOW programs over the last 10 years, this partnership has yielded nearly 500 woodstove change outs, with an emphasis on changing out devices in low-income households. From 2016 to 2018 alone, the WCOW program facilitated 128 change outs (upgraded to either certified wood-burning or non-wood burning devices), sparing the community 5.59 tons of $PM_{2.5}$ emissions per year. KCPH is currently under contract for the 2019-2021 biennium with DEQ to increase fuel switching in the nonattainment area. In partnership with SCOEDD, they will be changing out 49 wood burning heaters that are the primary household heat source to non-wood burning devices.

The proposed project would replace 300 wood stoves with non-wood burning devices and incentivize the conversion of 50 additional fireplaces to non-wood-burning devices over a 5-year period in the nonattainment area and nearby communities that affect the airshed. This should lead to a reduction of approximately 14.8 tons per year of $PM_{2.5}$, or about 10% of the annual contributions to $PM_{2.5}$ from residential wood combustion (all devices combined). Funding for the woodstove change outs will be capped at $5,000 per household for a total of $1.5 million. We chose replacement of the devices with non-wood burning devices to maximize the benefit to the airshed, and because the benefits to air quality from replacing uncertified wood burning devices with certified wood burning devices are proving to be less than anticipated.[3] Consistent with research and data coming out of New York State Energy Research and Development Authority, preliminary data from a research study funded by DEQ showed that even certified wood stoves could not reliably produce a benefit to air quality. The project will also include 50 fireplace replacement incentives of $900 for a total of $45,000. Although fireplaces are a lower contributor to the air quality, every little bit counts, and replacing 50 has the potential to prevent slightly more than half a ton of $PM_{2.5}$ emissions per year.

Low-income program participants will be prioritized and rental properties included since Klamath Falls has a high rental population, with only a 44% home ownership rate (Klamath Falls Housing Need Assessment). Historically only homes within the air quality zones were eligible for change outs, but participation for this program will be broadened to include adjacent communities that may affect the air quality zone. These outlying communities, such as Chiloquin, an incorporated city 25 miles north of Klamath Falls, and Keno, an unincorporated community 12 miles south west of Klamath Falls, are burdened by high poverty rates and experience

[3] Tony J. Ward , Christopher P. Palmer & Curtis W. Noonan (2010) Fine Particulate Matter Source Apportionment Following a Large Woodstove Changeout Program in Libby, Montana, Journal of the Air & Waste Management Association, 60:6, 688-693. https://doi.org/10.3155/1047-3289.60.6.688 (Accessed 1/29/20)

heavy woodsmoke. For years the primary focus of air quality interventions such as wood stove replacements have been centered in the air quality zone, leaving these nearby areas with few resources. For example, Chiloquin's poverty rate among households is 31.8% and their population is comprised predominantly of people of color with 47% Native American and 6.5% Hispanic/Latino compared to Klamath Falls' 23.1% poverty rate and a predominantly white population (78%).[4] According to the EPA's website,[5] tribal communities are often disproportionately affected by air pollution. This is a serious health equity issue and this proposal intends to begin addressing it. KCPH has a relationship with The Klamath Tribes and will build on that to implement the program there.

Weatherization is also a critical component of this project. Many homes in Klamath County are old and in need of repair. According to the Klamath Falls Housing Needs Assessment, the stock of rental homes are of poor to average quality. Inadequate insulation, old doors and windows, and other structural decay allows heat to escape, necessitating prolonged heating. Weatherization upgrades from this project will be provided for each home at a maximum of $2000, for a total of $600,000 budgeted for the project. Leveraged monies from Energy Trust Oregon will provide an additional $500 bringing the total value to $2500 per home. Priority will be given to individuals currently doing a woodstove change out, but residents who previously participated in change outs will be eligible.

SCOEDD has an efficient workflow and established relationships with local vendors and contractors to seamlessly lead the woodstove change out and weatherization process. They are well prepared to solicit residents to apply, send a trained Energy Assessor to the home to identify the heating unit to be removed, and produce a written report with recommendations of available heat sources and any home upgrades needed to accommodate the new heat source (ducting, electrical panel upgrade etc). SCOEDD then solicits contractor bids, oversees installation and permitting of the new heat source and weatherization upgrades, and ensure the old unit is properly decommissioned. SCOEDD also is familiar with the applicable local incentives available through Energy Trust of Oregon. This set of activities is expected to cost approximately $2.6 million over 5 years.

Scaling up EPA Burn Wise Wood Sheds to a Community-Scale Firewood Storage Facility

Klamath County Community Corrections (Corrections) partners with Klamath Lake Community Action Services (KLCAS) to provide free firewood for low income residents unable to afford to heat their homes. Each spring, Corrections clients (those supervised on parole and probation) cut approximately 120 cords of wood to fuel the program. Wood is then stored on their property to season for a few months. Some of the wood is stored on exposed open land, subject to rain and snow, but recently they have begun placing as much as possible under tarps. After being left to dry throughout the summer it is distributed throughout the winter for KLCAS clients.

Building on the EPA BurnWise program of building storage sheds[6] to maintain a properly dried and seasoned wood source for wood-burning households, this proposal scales the idea up about 30 times to propose the construction of a 30-foot by 40-foot pole barn that will have a storage capacity of well over 120 cords of wood. This barn will correctly store wood as it dries, for distribution to low-income community members throughout the winter. The building will be walled on three sides, with a gravel floor. It will be stationed at the corner of Vandenberg Road and Foothills Drive on Klamath County property, where the wood is currently stored. With the additional cost of building to current code requirements for seismic resilience, the estimated cost of such a building is $60,000.

Corrections would work with the $PM_{2.5}$ Resource Coordinator (see Strategy 2 below) to determine an efficient process to stack and store wood for distribution so only dry, seasoned wood is distributed. This process would include testing the wood prior to distribution to ensure only wood having 20 percent or less moisture content would be given away. Corrections typically depletes their firewood inventory each year; this proposal also includes a budget of $24,000 to buy 120 cords of wood to create a base inventory of dry seasoned wood. This would allow the annual inventory of newly chopped wood to be stored and dried for a full year prior to distribution. In addition, Klamath County Public Health will coordinate with a local community organization that works with disabled adults to build wood sheds that can be distributed to community members through the local community services agency that already maintains a list of low-income and other households with need for assistance for their wintertime heating activities in the amount of $500 per shed, and 100 sheds per year over 5 years.

Education is a critical component to any program, and finding natural settings to provide information is essential to reducing woodsmoke. Distributing materials at the time of firewood wood delivery is an excellent opportunity, so the PMRC will coordinate and provide BurnWise educational materials in both English and Spanish. In addition, the PMRC will encourage firewood recipients to participate in the woodstove change out program offered through SCOEDD.

Enhanced Community Education and Outreach

In 2012, KCPH started the School Flag Program through a $2,000 Supplemental Environmental Project (SEP) award. It is a program to educate youth and teachers about air quality and raise awareness in the community. The School Flag Program involves the posting and raising of different colored air quality flags on school grounds based on local air quality conditions, as well as class materials to educate students about air quality. The awareness goes beyond educating the schoolchildren to and extends into the surrounding neighborhood, as the school flags are a highly visible, daily reminder of air quality conditions.

Originally, six of the elementary school principals in the Klamath Falls City School District registered for the program and agreed to have a 5th class in each school raise the flag each school day. A teacher was designated to coordinate the program for each school and received the daily advisory each day. KCPH staff members gave presentations to the participating 5th grade classes that included a video and inversion demonstrations. Unfortunately in the last few years, KCPH has not had adequate resources to fully

[4] http://www.healthyklamath.org/index.php?module=indicators&controller=index
[5] https://www.epa.gov/tribal-air
[6] EPA Burn Wise. "How to Build a Wood Shed." https://www.epa.gov/burnwise/burn-wise-how-build-wood-shed (Accessed 1/29/20)

support the program, and now only three elementary schools are actively raising the flag each day and in-class presentations have ceased.

DEQ, in coordination with KCPH, envisions revitalizing the program and ensuring it becomes sustainable by integrating it into science and health classes at a minimum of 5 elementary schools. KCPH staff will train teachers on the program and provide information on resources available at www.airnow.gov/schoolflag, which include features such as online interactive courses, activity sheets, lesson plans, and an air quality simulator. Ensuring parents are aware of the School Flag Program is also an important component, so KCPH staff would help the schools publicize the program through school media channels in both English and Spanish.

In addition to the school flag program at the elementary schools, for which we are requesting $5,900, there is potential to engage older students with more in-depth, technical lessons. Dr. Addie Clark, a professor, and an undergraduate student from the local college, Oregon Institute of Technology (Oregon Tech), are excited at the prospect of developing an interactive, high school science lesson that includes real data from the local air quality monitors. This curriculum can be integrated into the local high schools to help satisfy science credit requirements as well as provide a real-world application of the lessons taught.

Finally, DEQ and KCPH will conduct additional education and outreach through paid and earned media campaigns to reach the general public. Paid and earned media stories will highlight the impacts of past and current interventions. Paid advertising will be posted on buses and billboards to remind people to check KCPH's burn restriction during the winter months and burn only dry, seasoned wood. Being mindful of Klamath's diverse population, providing linguistically and culturally appropriate messaging in-language is essential. KCPH currently holds a contract with a local, certified Spanish translator, so they will ensure all materials will be distributed and displayed in both English and Spanish. KCPH will engage Klamath Tribal Health and Family Services to ensure culturally appropriate messages are developed. English and Spanish BurnWise materials will also continue to be distributed at health fairs and downtown tabling events throughout the year. KCPH will also contract to have a LED sign installed on a high-traffic intersection in the nonattainment area, at Klamath Community College.

This set of community outreach and education activities is estimated to cost just under $100,000 over 5 years: Paid advertising ($70,000), translation ($8,000), additional materials & costs ($6,875). The LED sign will cost approximately $45,000.

Strategy 2. Dedicated, Strategic $PM_{2.5}$ Resource Coordination, Documentation, and Analysis

For decades, Oregon DEQ has conducted periodic surveys of household wood burning in order to understand trends in residential wood combustion and estimate emissions, with the intent of directing resources to the areas of greatest need for air quality improvements. These household heating surveys have been conducted in small communities, at single or multi-county scales, and at a statewide scale, with varying levels of detail.

Data collection and analysis, is a resource-intensive undertaking that requires dedicated time and expertise, as well as leadership. Surveys in recent years in Oregon have been limited due to resource constraints. The most recent household heating survey was conducted by Oregon Institute of Technology (Oregon Tech) in 2008. After a decade of focused effort in the Klamath Falls Nonattainment Area to change out wood stoves and reduce fine particulate matter pollution as outlined in the attainment plan, it would be significant and timely to be able to conduct another household wood burning survey at the highest possible level of detail. The results of these studies would help DEQ and KCPH document and evaluate the impacts of past and current efforts as well as provide information to refine the direction of future program investments and activities.

Data Collection and Analysis for Strategic Program Documentation, Evaluation, and Planning

This application proposes to improve air quality monitoring, add low cost community monitoring, and undertake two studies with the goal of developing a more fine grained spatial analysis of the factors impacting air quality throughout the Basin and evaluating the interventions aimed at improving it. In collaboration with our air quality monitoring department, DEQ proposes to add a ceiliometer to DEQ's Peterson School monitoring station and train community members in Klamath Falls to use low cost air sensors at five schools. With partners at Oregon Institute of Technology, DEQ and KCPH will produce a detailed spatial analysis of sources and sinks throughout the entire Klamath Basin, including the nonattainment area. The second study will be the household wood heating survey that updates a study conducted in 2008 by Oregon Tech and funded by DEQ.

i. Improve existing monitoring

The ceilometer provides "real-time" mixing height data that would substantially improve DEQ's ability to forecast poor air quality. Research has shown mixing height to be a significant air quality factor. Analyzing mixing height datasets, in conjunction with air quality data generated at DEQ's air quality monitoring sites, will help DEQ quantitatively assess the primary cause of many poor air quality events. These data can be particularly useful during winter months when mixing heights tend to be at their lowest levels and during wildfires, when any fluctuation in mixing height can greatly affect air quality. The addition of a ceilometer (cost is approximately $35,000 each) to DEQ's monitoring site will allow DEQ over time, as historical mixing height and air quality data are correlated, to be able to forecast air quality with greater accuracy. The nearest National Weather Service Station and mixing height measurement is in Medford, Oregon, which is on the other side of the southern Cascade Mountains and provides less than ideal mixing height estimates. This data is vital in determining an accurate wood stove advisory for each winter day during the wood heating season.

ii. Low-cost Community Monitoring

Low cost sensor technology provides an opportunity to characterize $PM_{2.5}$ concentrations with increased spatial and temporal resolution. An effective $PM_{2.5}$ reduction program should include efforts to educate, engage, and empower the community, providing information and support for air monitoring and outreach. Real time data will aid decision making, encourage changes to behavior, and

reduce exposure to $PM_{2.5}$ from smoke and other sources. DEQ and KCPH propose to install low cost air monitoring sensors in schools for community monitoring. The focus would be on education and improved spatial surveillance. ($3,500 per SensOR™ for five monitors plus one backup, $6,000 for additional supplies, and additional staffing for community outreach, training, and technical assistance).

iii. Klamath Basin wood smoke and air quality spatial analysis study

For the wood smoke sources and sinks study, the Oregon Institute of Technology's (Oregon Tech) Natural Sciences program will partner with KCPH to conduct in-depth spatial and statistical analyses to attempt to pinpoint the impacts of wood stove change outs, given the highly variable factors that contribute to wood stove use and wood smoke movement in the Basin: geography, wind speed, wind direction, temperature, and humidity, among others. This study also hopes to provide insight to air flow patterns and how wood smoke from outside the Air Quality Zone (AQZ) impacts air quality within it. This in-depth analysis aims to test the hypothesis that woodstove change outs provide significant air quality benefits while accounting for weather patterns.

The study consists of a two-pronged design: (1) evaluating the effectiveness of the on-going 300 wood stove change outs being conducted as a result of this proposal by looking at real-time data and monitors to evaluate the impact; and (2) determining the impact of previous woodstove change outs over the past 10 years by correlating it with historic air quality data. The study utilizes existing $PM_{2.5}$ monitoring from the FRM monitor located at Peterson Elementary School, and a second monitor located in the "hills" on the Oregon Tech campus. A third monitor is scheduled to be placed north of Klamath Falls, outside of the AQZ, at the Chiloquin fire district station by the end of February 2020.

If funded, this grant would allow the project to add a fourth monitor on the southeast end of the AQZ. This would allow investigators and regulators access to additional long-term data to examine air quality and the effect of wind patterns and other factors than in the initial saturation studies conducted in the winter months only by DEQ in 1996-1997, 2000-2001, and 2010-2011. Data from these monitors will be compared to examine the impacts of the air quality program inside and outside of the AQZ. HYSPLIT analyses will analyze whether directional air masses are impacting the AQZ and assess the impact of the proposed 300 woodstove change outs. Oregon Tech has already begun some of this work and it is scheduled to conclude in March 2021. This grant would fund the addition of one monitor and support the time of the Principal investigator, Dr. Addie Clark, and a student, at the level of approximately $65,000 over 5 years.

After the data collected during the two-year study period is analyzed, publication of the results will be sought in a peer-reviewed journals. These results will also be submitted to the County Health Rankings and Healthy Communities Institute 'Best Practices' databases, and they would represent a unique data point in that data -- studies representing rural communities are not well represented in that data set.

iv. Air Quality Zone household heating and wood use survey

Like the household wood burning survey conducted by Oregon Tech in 2008, this survey will allow regulators to better assess and target wood burning reduction efforts. This detailed household-by-household inventory will identify the distribution and frequency of household heating device types both inside and outside of the AQZ. Based on the extensive surveys conducted by DEQ with Oregon Tech in Klamath County in 2008 and again in the tri-county Portland Metropolitan Area Surveys in 2014, Oregon Tech will conduct a survey of household heating and wood burning inside and outside of the nonattainment area. Interviews will be conducted that document the frequency of use, timing, and types of home heating devices utilized. Spatial analysis in GIS will identify the locations and concentrations of residential heating devices throughout the area. Information from this survey will be used to analyze population level impacts of the wood stove change out programs, and incorporated into the residential heating upgrade program to specifically target and give preference to areas of the community with concentrated need for air quality improvements. This information can also be used to provide detailed, location-specific estimates for emissions inventory, state implementation planning, and health impact analyses. We anticipate this to cost approximately $75,000.

v. Prescribed burning coordination

DEQ and Klamath County have worked with the local forest land managers (USFS and private) to coordinate on prescribed fire burning during the winter time months of November through February. Prescribed fire is a highly variable component of the emissions inventory that is a significant contributor to annual $PM_{2.5}$ emissions when it is present. As part of the original attainment plan activities, a Memorandum of Understanding (MOU) for burning during this time period already exists between DEQ, USFS, BLM, Klamath County for federally owned properties, and a new MOU with the largest private land owner in the area, Green Diamond Resources is in the process of approval by all parties. It entails an agreement between Green Diamond, Oregon Department of Forestry, DEQ, and Klamath County that Green Diamond will not burn or place smoke into the AQZ during the November through February months and with special attention to poor air quality days. The MOU with our Federal Partners assures there is no burning on Red air quality advisory days and smoke does not impact the AQZ on Yellow advisory days. This language is also codified in the Oregon Department of Forestry Rules on the Smoke Management Program.

$PM_{2.5}$ Program Resource Coordination and Oversight

Current $PM_{2.5}$ air quality program activities in the Klamath Falls nonattainment area are conducted by KCPH air quality specialists, whose time is shared with three other programs. The proposed program requires full-time dedication and coordination. The TAG $PM_{2.5}$ Program Resource Coordinator (PMRC) will serve as primary program coordinator for grant activities and will be awarded as a sub-contract ($525,000 over five years). The goal of the PMRC will be to (1) Manage the various components of Strategy 1; (2)

Coordinate and implement agreements to reduce $PM_{2.5}$, (3) Project documentation and data analysis, and (4) Lead and manage Strategy 3. This position will be maintained and overseen by KCPH.

On Strategy 1, the PMRC will be the main point of contact for the wood stove change out and weatherization contract. In addition they will (1) gather and convene the Klamath County Air Quality Committee on a quarterly basis: lead inter-agency coordination between DEQ, KCPH, SCOEDD, US EPA, US Forest Service, Energy Trust of Oregon, and other local non-profit and business partners; (2) lead the expansion of the community firewood program (3) lead on enhancing local code enforcement and ordinance update; and (4) conduct community and school-based education and outreach activities ~~as~~

On Strategy 2 & 3, the PMRC will oversee and manage the contracts to develop the spatial analysis study and woodstove survey, working closely with Oregon Tech to develop the survey questions and review results. The PMRC will also oversee development of the feasibility study to analyze the full cost of upgrading and converting the public transportation bus fleet to utilize alternate fuels or electricity conducted by an outside consultant, as described below.

The PMRC will oversee program tracking and provides updates on a monthly/quarterly basis to DEQ and Klamath County Board of Commissioners.

Strategy 3. On-road vehicles emissions reductions

As the contribution of $PM_{2.5}$ emissions from woodstoves decreases in Klamath Falls, the contribution of other sectors, such as on-road emissions, will start to rise. On-road sources of emissions are often overlooked in rural communities due to lack of traffic volume, but the geographic spread of the Klamath Basin lends itself to higher mileage driven. The Basin Transit Service Transportation District (BTS) is Klamath County's largest public transportation service. They currently have 13 buses that travel an average of 337,665 miles every year. There is great potential to reduce future emissions by decreasing the age and improving the quality of the bus fleet.

BTS is planning for the future and is scheduled for their next round of bus replacements around 2025. They understand the importance of reducing emissions and helping contribute to cleaner air in the community. To reduce their carbon footprint, the director of BTS is considering electric or natural gas buses, however there are several logistical unknowns. There are infrastructure considerations for fueling or charging stations. Also considerations such as performance, mileage, return on investment, and maintenance costs will impact decisions made by BTS. For example, understanding how far a bus can run on a single charge, particularly in the harsh winter weather experienced in Klamath, may affect the decision. BTS is monitoring neighboring counties that have purchased some of these buses, but a true, methodical feasibility study conducted with rigor would be a preferable method to making a sizeable investment. This study will require a significant amount of time and expertise, so a consultant would be hired to conduct a feasibility study, which would culminate in a detailed report with recommendations. BTS has also agreed to offer free public transportation on red and yellow days. The estimated cost of this free rides program is [X].

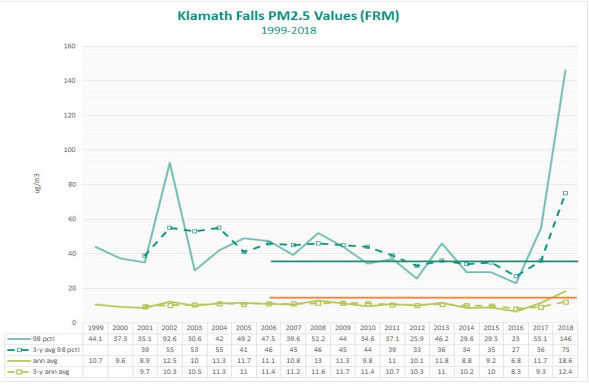
KCPH has also partnered with Klamath Falls School District, Klamath County School District, and Oregon Child Development Coalition to convert up to 39 diesel school buses to propane injection at a cost of approximately $130,000 each. Together these school districts serve thousands of schoolchildren. For instance, Migrant and Seasonal Head Start and Early Head Start, run by OCDC, provide comprehensive child development services to economically disadvantaged children and families. Migrant and Seasonal Head Start are for children of migrant and seasonal farm workers. This program cares for children while parents are working in the fields, and helps preschoolers develop the language, reading and math skills they need to be successful in school. Early Head Start provides services to pregnant woman, infants and toddlers up to age 3. Early Head Start cares for infants and toddlers to make sure that young children grow up to be healthy and happy.[7] Making sure that schoolchildren are not exposed to toxic diesel pollution and particulate matter on their way to and from school and programs is a key benefit of this strategy, dovetailing with public health goals for the area.

B. Emissions Inventory and Progress Toward Attainment

The table below shows the calculated emissions inventories for the Klamath Falls Nonattainment Area for 2008 and 2017,

Figure 1. The table on the left shows the 2008 and 2017 emissions inventory for the Klamath Falls Nonattainment Area. The figure on the right is a chart of the annual and 3-year averages of the daily 24-hour and 98th percentile values of the $PM_{2.5}$ readings at the Peterson School.

Category	Klamath Falls Non-Attainment Area PM2.5 Emissions							
	2012 Attainment SIP				2020 Maintenance Plan			
	2008 Base Yr	%	2008 WCD	%	2017 Base Yr	%	2017 TSD	%
	Tons per year		Pounds Per Day		Tons per year		Pounds Per Day	
Area / Nonpoint	**403**	**62%**	**2850**	**53%**	**232.7**	**48%**	**1897**	**56%**
Residential Wood Combustion	165	25%	2173	40%	140.8	29%	1464	43%
Wildfires / Prescribed Fires *	107		459		0.0		0	
Fugitive Dust (incl Construction, Biogenics, Ag	97.7	15%	74	1%	29.6	6%	97	3%
Waste Disposal Treatment and Recovery	12.8	2%	50	1%	29.4	6%	161	5%
Small Stationary Fossil Fuel Combustion	3.1	0%	36	1%	3.6	1%	29	1%
Evaporative/Off-Gassing Emissions Sources	0		0		0.0		0	
Miscellaneous AREA Sources	17.4		58		29.4		147	
Commercial Food Preparation	*9.9*		*18*		*23.2*		*127*	
Agriculture Field Burning	*7.2*		*39*		*1.9*		*5*	
Structural Fires	*0.3*		*1*		*0.0*		*0*	
Point	**143.4**	**26%**	**1517**	**31%**	**158.5**	**33%**	**1002**	**30%**
On-Road	**92.2**	**17%**	**917**	**18%**	**39.4**	**8%**	**201**	**6%**
Nonroad (includes airports and rail in both 2008 a	**16.1**	**3%**	**135**	**3%**	**31.0**	**6%**	**163**	**5%**
Grand Total	**654.7**		**5419**		**486.7**		**3396**	



[7] "Migrant, Seasonal, and Early Head Start." http://www.ocdc.net/programs/ (Accessed 3/4/20)

based on the National Emissions Inventories for the corresponding years. The 2008 inventory was calculated for the Klamath Falls $PM_{2.5}$ attainment plan, while the 2017 inventory is in the process of being calculated for the Klamath Falls $PM_{2.5}$ first 10-year maintenance plan, and has been prepared in conjunction with our contacts at EPA Region 10.

Based on these calculations, the nonpoint or area source category remains the largest source category contributing to $PM_{2.5}$ emissions in the nonattainment area in 2017. Within the nonpoint source category, residential wood combustion continues to be the largest source of $PM_{2.5}$ emissions, representing 29% of the total annual $PM_{2.5}$ emissions in the nonpoint source category, or 43% of the total $PM_{2.5}$ emissions on a typical season day. Additional information on other precursor pollutants as well as the methods used to develop these estimates are presented in the emissions inventory attachment. $PM_{2.5}$ emissions from residential wood combustion have decreased from 165 tons per year in 2008 to 140.8 tons per year PM2.5 in 2017, and the relative contribution of residential wood combustion as part of the inventory has stayed roughly the same (from 25% to 29%), but this can be accounted for due to the absence of wildfire and prescribed fire emissions from within the nonattainment area in 2017. On worst case days, the estimated contribution in 2008 was 2173 pounds per day, or 40% of emissions, while in 2017, the estimate on a typical season day was 1464 pounds per day, or 43%. While emissions have decreased since the attainment plan strategies was put into place, they have not decreased to the amount forecasted in the original attainment plan estimates.

The figure to the right of the table shows the 3-year design values for $PM_{2.5}$ at the Peterson School monitor, with the 24-hour values in teal and the annual averages in lime green. Monitor data shows $PM_{2.5}$ levels steadily declining over time, but with some challenges in consistently staying below the 35 µg/m3 standard, and not to the degree estimated in the attainment plan. By solely focusing on change outs of wood stoves to electric heat, and from diesel buses to electric or natural gas vehicles, DEQ and KCPH are attempting to maximize the benefits of the change out programs to improving air quality and lowering emissions in the nonattainment area. Additional information on emissions reductions are located in the emissions reductions attachment. DEQ estimates that replacing 300 wood stoves with ductless heat pumps will achieve 14.2 tons per year benefit to $PM_{2.5}$, with an additional 0.6 ton per year benefit from replacing fireplaces with gas inserts. The Klamath Falls Attainment Plan estimates an additional reduction of 0.6 $\mu g/m^3$ from education and outreach. For the public transportation fleet upgrade, DEQ estimates annual emission reductions at 0.44 tpy NO_x, .007 tpy $PM_{2.5}$, and 8,865 gallons of fuel saved (100% reductions) and expected lifetime emissions reductions to be 3.6 tons NO_x, 0.06 tons $PM_{2.5}$, and 409,248 gallons of fuel (100% reductions).

C. Innovative Emissions Reductions

The strategies outlined above are a combination of proven, tested programs that have been implemented over the past 30 years when Klamath was first designated nonattainment for PM_{10} as well as newer innovative approaches to continually address the need of reducing $PM_{2.5}$ levels. These strategies have involved stakeholder input and commitment in light of numerous challenges in the area. The core element of the proposal is to address wood smoke emissions, through wood stove change outs, education, and firewood exchange.

In Klamath Falls, wood burning is a long practiced tradition. With plentiful wood available and a strong culture of wood stove use, wood burning is an inherent part of many Oregonians' lives especially in Klamath Falls where mills have a long-standing history. Engaging and educating youth through school programming is a mechanism to change the conversation from nostalgia to science and environmental health.

Topography and weather inversions affect the area. Klamath Falls sits in a basin confined by hills and a system of elongated ridges on the east and west~~,~~ Because of these topographical features, Klamath will continually experience nighttime inversions which will trap any lingering woodsmoke in the area. Through this proposal of removing the older polluting stoves with newer devices or those that do not emit any PM, it will help reduce the amount of woodsmoke in the airshed.

At some point, Klamath will reach a saturation point in which wood stove change outs are no longer an option, either because the majority have been changed out or because residents refuse to let go of their wood stove as their primary source of heat. This necessitates the need to look at alternate forms of emission reductions. Turning our gaze to on-road sources, such as the public transportation system, is an innovative strategy for Klamath. If addressed, it could spare up to 3.6 lifetime tons of NO_x, 0.06 tons of $PM_{2.5}$, 4,604 tons CO_2, and 409,248 gallons of fuel over the remaining lifetimes of the vehicles, and act as a trailblazer for other rural public transportation systems.

Having local data proving the effectiveness of these interventions will be critical to earning the community's buy in. The in-depth analysis that examines both the intervention (change outs) as well as influencing factors (weather patterns) may be the first of its kind for a rural community, which will add to the growing body of knowledge. Leveraging relationships through Oregon Tech is a cost effective way to utilize local expertise.

D. Roles and Responsibilities

DEQ celebrated its fiftieth anniversary as the state's environmental agency in 2019. Over the years, DEQ has received numerous Federal and State grants and has consistently followed the terms set by the granting agency for all the projects in which DEQ has been involved.

Project partners include:

- Klamath County Public Health is the local public health authority for Klamath County and oversees enforcement of the Clean Air Ordinance. As trusted local experts, KCPH staff will be the primary agency completing or coordinating the deliverables of this project.

- South Central Oregon Economic Development District will oversee and conduct the wood stove replacements and weatherization upgrades.
- Oregon Institute of Technology will conduct the data analysis for the wood smoke spatial modeling study, the household wood burning survey, and create an interactive high school air quality lesson.
- Basin Transportation Services is Klamath County's largest public transportation provider seeking to reduce its emissions as the bus fleet is upgraded. They will participate in an on-road mobile emissions reductions study to guide their decision making.

Agency / Organization	Role	Responsibility
Oregon Department of Environmental Quality	Lead Agency	● Overall grant administration ● Reporting to EPA ● Financial oversight ● Program oversight
Klamath County Public Health	Grant Partner, Lead Local Agency	● Program administration ● Oversee subcontracts and local agency partnerships (BTS, OIT) ● Reporting to DEQ ● Lead implementation of Education and Outreach (Strategy 1) ● Lead implementation of Community-scale wood storage facility (Strategy 1)
South Central Economic Development District	Partner, sub-grantee	● Implementation of woodstove change out and weatherization program (Strategy 1)
Oregon Institute of Technology	Partner, sub-grantee	● Implementation of spatial modeling study and household wood burning survey (Strategy 2)
Basin Transportation Services	Partner, sub-grantee	● Implement On road mobile emissions reductions study (Strategy 3)
Klamath County Community Corrections	Partner, sub-grantee	● Implementation of scaling up EPA Burn Wise wood sheds to a community-scale firewood program (Strategy 1)
Klamath County Community Action Services	Partner	● implementation of delivery of dry, seasoned community firewood to low-income households throughout each winter heating season
Klamath Falls School District	Partner, sub-grantee	● Convert all diesel school buses to propane injection by 2025
Klamath County School District	Partner, sub-grantee	● Convert all diesel school buses to propane injection by 2025
Oregon Community Development Coalition / Migrant. Seasonal, and Early Head Start	Partner, sub-grantee	● Convert all diesel school buses to propane injection by 2025

Section 2. Community Benefits, Engagement and Partnerships

A. Community Benefits

All Klamath residents have a stake in this project, as the air they breathe is a shared experience that affects health. The Klamath Falls community experiences high levels of $PM_{2.5}$ during the winter months, primarily due to woodstoves. Replacing non-certified wood stoves with non-wood burning devices and providing clean and dry firewood reduces emissions.

Poor air quality is particularly burdensome for children, elderly, and those with preexisting medical conditions that affect the respiratory and cardiovascular systems. In Klamath Falls, one in five (21%) community members are older adults, aged 64 or older, as compared to 17.6% and 16% at the state and national levels. These populations often have preexisting conditions that make them even more vulnerable to the effects of air pollution. In addition, compared to the Oregon rate of 40.1 deaths per 100,000, Klamath County is on an upward trend at 65.9 per 100,000 deaths due to Chronic Lower Respiratory Disease, which is an umbrella term that includes asthma, emphysema, bronchitis, and COPD. Reducing emissions may improve these health outcomes and increase wellbeing for the older adult population. In addition, communities outside of the air quality zone have been excluded from previous woodstove change out efforts, causing inequitable burden on them. This round of change outs will be more focused and intentional to ensure they have the opportunity to participate.

Poor air quality can also have a negative impact on the economy. When Klamath Falls was designated as a nonattainment area for PM_{10} in1988 and later $PM_{2.5}$ in 2008, it carried several economic implications. Core industries of the Klamath Basin were affected, limiting the businesses that could operate in the county without extensively limiting their emissions. Although there are few large Title-V regulated facilities, the ones in the area all have acquired state-of-the-art controls due to past non-attainment area issues, Maximum Achievable Control Technology (MACT) requirements for wood products industry, and Best Available Control Technology (BACT) for the natural gas-fired power plant. There are no significant industrial sources of $PM_{2.5}$ left uncontrolled. Despite these gains, emissions reductions are critical because, even if the industries weren't the primary cause of going into serious nonattainment,

they would suffer devastating consequences, particularly the wood products manufacturing which makes up 65% of all manufacturing in the region. Industry would have very little room to expand or change operations which impacts the ability of the area to retain its manufacturing base and recruit new operations. Being in a timber rich area, industries related to wood products are and have been a strong element to the local economy. The community has already been negatively impacted by the closure of several wood products mills in town over the past 20 years, and the nonattainment designation makes it even harder for new industry to locate in the area. As the $PM_{2.5}$ challenges are centered around wood stoves, it is incumbent upon the community to reduce these emissions as much as possible and retain their ability to create and keep jobs.

Klamath Falls struggles with poverty. 23.1% of people are living below the poverty level compared to state and national averages of 14.9% and 14.6% respectively.[8] According to the Klamath Falls City Housing Needs Assessment, only about 42.6% of homes are owner occupied compared with 69.1% on the state level. Furthermore, the report states that there is an abundance of rundown rental properties. Low-income residents are less able to afford to replace their uncertified stove and typically find the cost of heating with alternate sources during particularly cold weather events to be too expensive. Additionally, many homes, both owner and renter-occupied, are old and poorly weatherized. The combination of an inefficient heating mechanism and a home that allows heat to escape results in a poorly heated house, prolonged wood stove use, and poor air quality (indoor and outdoor) burdening the lower income population. Prioritizing low income homes, both rental and owned, and providing wood stove change outs paired with weatherization, will provide community benefit, particularly to those most at risk.

B. COMMUNITY ENGAGEMENT AND PARTNERSHIPS

Over the past thirty years, DEQ has worked closely with the Klamath Falls community to decrease $PM_{2.5}$ levels in the area. In particular, DEQ has worked directly with KCPH to highlight and identify strategies to address wood smoke. This has involved Klamath County enforcing the Clean Air Ordinance, which includes burning restrictions on poor air quality days, conducting education and outreach, and most recently, collaborating with SCOEDD to provide wood stove change outs. Klamath County has been staffed with a part time air quality coordinator to oversee these activities. In addition, DEQ and KCPH worked together to form an air quality stakeholder group incorporating members of the public, industry, wood heating representatives, local businesses, and federal and local government entities, as well as non-governmental organizations. The stakeholder group has met sporadically throughout the years, but on a bi-monthly dedicated basis during development of PM_{10} and $PM_{2.5}$ attainment and maintenance plans. Moving forward, the air quality advisory group will be resurrected, strengthened, and mobilized more consistently as the maintenance plan is implemented and updates to the Clean Air Ordinance are discussed.

Communication with prescribed burning stakeholders has improved over the years as well. Fire districts, Oregon Department of Forestry, U.S. Forest Service, KCPH, and DEQ have come together to notify each other about prescribed burning dates and locations, and jointly determine open burn dates for the broader community. Being mindful of each agency's activities, weather forecasts, and air quality readings serve to reduce the burden of $PM_{2.5}$ on the community and maintain positive inter-agency relationships.

Through the years, relationships have strengthened between KCPH and Oregon Tech. Data sharing and collaborative projects have built a strong foundation from which to build. The university is hungry for applied, experiential learning opportunities for its students. Meanwhile, the community continuously seeks ways to integrate Oregon Tech's professional expertise and human power supplied by the students to enhance program and research projects. Since 2014, KCPH has held a formal agreement with Oregon Tech and is currently working on its sixth project with them.

KCPH also intends to engage the community through multimedia platforms. Community partners act as gatekeepers to a variety of stakeholders, but for the general public, mass media is an effective way to engage the public. The Herald and News is the local newspaper that reaches over 10,000 citizens. KOTI is the local news station that often features air quality topics, and recently aired two segments--one on Dr. Clark's air quality research and the other on the current wood stove change out project. KCPH regularly submits press releases that are picked up by these news outlets. For citizens that do not consume news through print or television, social media can help fill the gap. KCPH maintains an active Facebook and Twitter account that are utilized to convey important public health information. Last year KCPH conducted a media campaign that utilized paid social media, billboards, and bus ads. On social media alone, they achieved 26,306 video views.

Section 3 - Project Sustainability

In the past, wood stove change out projects allowed uncertified wood stoves to be replaced with certified units. That may have reduced the $PM_{2.5}$ emissions if residents were burning correctly, but it still perpetuates a culture of wood burning. Furthermore, as emissions standards become more stringent, certified stoves that were installed a few years ago no longer meet the criteria to be certified. This project will provide long-term and permanent emission reductions through removal of wood stoves and replacement with non-wood burning devices. While this project funding will not be able to changeover all uncertified devices in the area, the 300 proposed for this project will make a significant, long term impact. DEQ will continue to pursue additional monies to complete the conversion of these devices to cleaner burning ones. In addition, facilitating an on-road emissions reduction study for the public transportation system sets the stage for lower emission buses when the time comes to update the fleet. Planning for the future of public transportation with emissions reductions at the forefront will provide lasting impact throughout the Klamath Basin. The wood stove change out effectiveness study and household heating inventory will provide much needed data to provide strengthened grant

[8] http://www.healthyklamath.org/index.php?module=indicators&controller=index

applications and potentially secure funding from elected officials. The advisory committee will ensure the Clean Air Ordinance is updated to meet the demands of attainment and maintenance. These actions, coupled with the additional projects identified in this grant will help achieve the $PM_{2.5}$ reductions needed to help the area reach attainment with the standard.

Section 4 - Environmental Results - Outcomes, Outputs and Performance Measures

A. EXPECTED PROJECT OUTPUTS AND OUTCOMES

Outputs	*Outcomes*
Strategy 1. Permanent, deep reductions in $PM_{2.5}$ from residential wood combustion	
● Replace 300 uncertified and non-Step 2-certified wood stoves with non-wood heating devices such as ductless heat pumps. ● Install upgraded weatherization for up to 300 homes.	● Annual emission reduced: 14.2 tons $PM_{2.5}$, 0.2 tons SO_2, 1.3 tons NO_x, 24.6 tons VOCs, and 2.6 tons HAPs ● Expected lifetime emission reductions are 284 to 426 tons $PM_{2.5}$, 4 to 6 tons SO_2, 26 to 39 tons NO_x, 492 to 738 tons VOCs, and 52 to 78 tons HAPs, based on 20 to 30-year average additional life (heat pumps may require some maintenance-replacement at 15-20 years).
● Replace 50 fireplaces with gas inserts	● Annual emissions reductions: 0.6 tons $PM_{2.5}$, 0.07 tons (140 pounds) NO_x, 0.5 tons VOCs, 0.13 tons HAPs. ● Lifetime emissions reductions based on 50-year life: 3 tons $PM_{2.5}$, 0.35 tons NO_x, 25 tons VOCs, 6.5 tons HAPs.
● Provide 120 cords of dry, seasoned wood through community firewood program.	● Increased availability of clean wood fuel, resulting in higher wood stove efficiency and reduced emissions
● Construct one large community scale wood storage facility and several household sized wood shed	● Provide seasoned wood to households in the nonattainment area and a wood shed.
● Education and outreach	● Increased public participation in programs as a result of improved education and outreach efforts ● Increased public awareness of project and results ● Improved burning practices by those who continue to use wood stoves
Strategy 2. Strategic data collection and analysis for documentation, evaluation	
● Add ceiliometer at Peterson School	● Improved air quality forecasting, resulting in more accurate advisories regarding wood stove curtailment
● Install 5 SensORs at schools in Klamath Falls ● Train school staff and community members on how to interpret air quality data from low-cost sensors	● Increased awareness of air quality and effects on public health ● Youth air quality ambassadors
● Spatial wood smoke sources and sink modeling study	● An understanding of the effectiveness of wood stove change outs and providing for calculated future interventions
● Household wood burning survey	● Increased understanding of effects of woodstove change outs on air quality and where to focus future wood stove replacement efforts
Strategy 3. On road mobile emissions reductions	
● Feasibility study with Basin Transit Service regarding fleet fuel shift starting about 2025	● Annual emission reductions: 0.44 tpy NO_x, .007 tpy $PM_{2.5}$, 8,865 gallons per year (100% reductions) ● Expected lifetime emissions reductions: 3.6 tons NO_x, 0.06 tons $PM_{2.5}$, 409,248 gallons of fuel (100% reductions)
● Diesel School bus conversions to propane injection	● Annual emission reductions from all fleets: 4 tpy NO_x, 0.3 tpy $PM_{2.5}$ (96+% reductions) ● Expected lifetime emissions reductions: 10 tons NO_x, 0.513 tons $PM_{2.5}$

B. PERFORMANCE MEASURES

DEQ will report, on a quarterly basis, the following measures:

Project Activity	*Performance Measure*
Strategy 1. Permanent, deep reductions in $PM_{2.5}$ from residential wood combustion	
Woodstove changeout and weatherization	● Number of applicants, and percentage of whom are low-income ● Number of wood stoves changed out, cost, and percentage of whom are low-income ● Number of homes weatherized, cost, and percentage of whom are low-income ● Number of fireplaces replaced, cost, and percentage of whom are low-income
Community-scale wood storage facility and community firewood program	● Wood storage facility construction progress / completion ● Number of service hours leveraged

Project Activity	*Performance Measure*
	● Number of cords chopped ● Number of cords wood distributed ● Moisture content of wood distributed ● Number of Burnwise materials distributed ● Number of household sized wood sheds constructed and delivered
Education and outreach	● Number of elementary schools participating in the School Flag Program ● Number of air quality lessons taught in high school science classes ● At least 2 billboards and 5 buses will have burn restriction messages ● Number of media releases issued weekly during the winter woodheating months (includes social media posts)
Strategy 2. Dedicated, Strategic $PM_{2.5}$ Resource Coordination, Documentation, and Analysis	
Upgrading monitoring at the Peterson School	● Ceiliometer installed and functioning
Low cost air quality monitoring at schools	● Number of monitors purchased and installed ● Number of students and/or community members trained on low cost air sensors data interpretation and air quality
Spatial wood smoke sources and sink modeling study	● Number of monitors ● Number of hours / days of air quality monitoring data ● Data analysis, results, and report ● Number of student research assistant hours leveraged
Household wood burning survey	● Survey instrument ● Numbers of surveys sent out ● Number of responses ● Data analysis, results, and report
PM2.5 Resource Coordinator	● Number of Air Quality Committee meetings convened, agendas, attendees, minutes of meetings ● Quarterly reports to AQC on activities, outcomes, etc.
Strategy 3. On road mobile emissions reductions	
Feasibility study with Basin Transit Service regarding fleet fuel shift starting about 2025	● Feasibility study with: ○ Total cost of fuel shift ○ Total emissions benefits of fuel shift ○ Infrastructural needs of fuel shift ○ Recommendations & next steps;
Converting diesel school buses to propane injection in multiple agencies	● Number of diesel school bus conversions to propane injection ● Miles traveled per year ● Total emissions reduced ● Gallons fuel saved

C. PERFORMANCE PLAN

The PMRC, as the primary point of contact between DEQ and KCPH, will be charged with detailed progress tracking for all projects, following the outcomes, performance measures, and timeline and milestones the previous 2 and following section. Reports will be submitted quarterly by contractors, and quarterly meetings with the Klamath County Air Quality Committee, including DEQ and all project partners, will include review of progress being achieved, discuss challenges, and troubleshoot as needed. A detailed workplan, complete with tracking mechanisms for each strategy area, will be created to provide organization, milestones, and continuity throughout the 5 year project. Quarterly check-ins with DEQ will ensure continuous monitoring and opportunities for improvement. Short term and long term results are presented in Timeline and Milestones, outputs and outcomes, and Performance Measures.

DEQ will provide quarterly reports to EPA on the progress achieved by the contractors, vendors, and education efforts. Data collected will be submitted and reported as required. This information may include the number of appliances removed, the number of appliances converted, and the number and types of appliances installed as a result of conversion, and other outcomes as indicated in Section 4B of this proposal. This data will be used to determine emissions benefit calculations, which will provide an overall calculation of $PM_{2.5}$ emissions removed from the nonattainment area. The reports will allow us to track whether the short-term and long-term outcomes are being achieved and reductions realized. It will also allow us to observe the performance of the project and whether adjustments need to be made.

D. Timeline and Milestones

Year	Milestones
2020 (Sept - Dec)	Grant awarded, negotiated, signed Sub-grants awarded, successfully through procurement, signed

Year	Milestones
2021	Any other sub-grants awarded & wrapped up Strategy 1: ● Woodstove change outs and weatherization - 60 ● Fireplaces replaced - 10 ● Wood storage facility built ● 120 cords wood bought and stored ● Education & outreach - ongoing ○ School program (Number of presentations? Number of people reached?) ○ Additional measures (media, billboards, etc) Strategy 2: ● Ceiliometer deployed ● School monitors deployed (5) ○ Number of people trained in low cost air monitors data interpretation ● Additional monitor deployed for OIT study ● Household survey completed Strategy 3: ● BTS Feasibility study in progress ● Fare free days Reports of sub-grants to DEQ Report to EPA
2022	Sub-grant amendments issued Strategy 1: ● Woodstove changeouts and weatherization - 60 ● Fireplaces replaced - 10 ● 150 cords wood chopped and seasoned wood delivered to low-income households ● Education & outreach - ongoing ○ School program (Number of presentations, Number of people reached) ○ Additional measures (meda, billboards, etc) Strategy 2: ● Number of people trained in low cost air monitors data interpretation ● Wood smoke spatial analysis study complete, analyzed, report generated ● Household survey data analyzed, report finalized Strategy 3: ● BTS Feasibility Study complete, report generated ● School buses being converted Reports of sub-grants to DEQ Report to EPA
2023 - 2025 (each year)	Sub-grant amendments issued Strategy 1: ● Woodstove changeouts and weatherization - 60 ● Fireplaces replaced - 10 ● 150 cords wood chopped and seasoned wood delivered to low-income households ● Education & outreach - ongoing ○ School program (Number of presentations? Number of people reached?) ○ Additional measures (media, billboards, etc) Strategy 2: ● Number of people trained in low cost air monitors data interpretation Strategy 3. ● School buses being converted Reports of sub-grants to DEQ Report to EPA

Section 5 - Programmatic Capability and Reporting Requirements

A & B. MANAGEMENT, COMPLETION AND REPORTING REQUIREMENTS
Assistance agreement numbers: DS-01J35901 & DS-01J63701
Project title: FY17- 18 School Bus Replacement Program & FY 2019 School Bus Replacement Project
Brief description of the agreement: These agreements are providing assistance to Oregon DEQ in support of its efforts to reduce diesel emissions and exposure throughout the state of Oregon. ODEQ is using funds under these grants to replace, repower or retrofit

a minimum of 45 diesel-powered school buses, which will reduce emissions of diesel particulate matter and other pollutants such as nitrogen oxides, carbon monoxide, and hydrocarbons.
Federal agency and CFDA number: Environmental Protection Agency, 66.040
Whether and how the applicant was able to successfully manage and complete the agreement: These grants are state allocations under the EPA Diesel Emissions Reduction Act. Oregon uses matching funds from the Volkswagen Settlement fund to bring additional Federal dollars into Oregon aimed at reducing diesel emissions. Our timeline for implementation was delayed due to a delay in availability of matching funds and EPA staffing changes that delayed a signed FY2018 agreement. However, once these issues were dealt with and the needed extensions were granted ODEQ moved quickly to get all of the FY17-18 funds obligated. FY 2019 funds are currently partially obligated and ODEQ continues to onboard new subgrantees. ODEQ has provided quarterly updates on time throughout the project term and the Project Manager regularly checks-in with the EPA Project Officer. EPA managers have communicated to our agency Director acknowledging our good work under these agreements.

Assistance agreement numbers: XA-01J41501
Project title: Improving Diesel Particulate Matter Exposure Assessment for Vulnerable Populations
Brief description of the agreement: This project is studying the public health impacts of poorly characterized diesel emissions sources (marine, locomotive, construction and freight), with particular attention to the potentially significant adverse exposure effects for vulnerable populations including low-income residents and communities of color. These groups are more likely to be affected by air pollution and limited transportation options that contribute to chronic health diseases such as asthma, cancer, heart disease, diabetes and stroke.
Federal agency and CFDA number: Environmental Protection Agency, 66.034
Whether and how the applicant was able to successfully manage and complete the agreement: Following initial difficulties in air pollutant plume capture from locomotives additional time was spent improving specialized capture techniques. Marine diesel plume capture and monitoring around high value construction sites followed. Community monitoring is the next stage in the project and is currently ongoing at the first of two locations. Despite delays the project is on track to be completed by August of 2021. The delays were communicated to EPA and extensions granted to allow for more time to conduct the source and community monitoring because of the technical difficulties encountered while attempting new monitoring techniques. ODEQ has provided biennial updates on time throughout the project term and the Project Manager regularly checks-in with the EPA Project Officer.

C. STAFF EXPERTISE (See Attachment for more detailed bios)

Key DEQ staff: Peter Brewer, P.E., is DEQ's Air Quality Attainment Coordinator & Wildfire Smoke Response Coordinator with over 33 years of environmental experience primarily in the field of air quality, and works with different communities on $PM_{2.5}$ challenges and manages their grant contracts. D Pei Wu, PhD, Air Quality Planner is the lead planner on the Regional Haze Program, and for Klamath Falls $PM_{2.5}$ State Implementation Planning-related activities and has worked at the intersection of environmental data analysis and public policy since 1989. Melinda Mahoney, is DEQ's Air Quality Grant Financial Officer and manages the financial aspects of DEQ's CAA 105 and 103 grants including sub-awards to other governmental agencies for work under those grants. Other DEQ staff include, Anthony Barnack, an Air Quality Monitoring Operations and Data Systems Lead has worked with DEQ for over 20 years; Rachel Sakata, Air Quality Planner who for 11 years served as the lead technical staff person for particulate matter and woodstoves issues; Michael Orman, Air Quality Planning Manager who has been with DEQ since 2016; and Ali Mirzakhalili, Air Quality Division Administrator, who has been leading the Air Quality Division since 2018.

Klamath County Public Health. The team at KCPH will serve as the local team working towards the deliverables outlined in this project. Jennifer Little, Director of KPCH, has her Masters in Public Health, Ramona Quinn, the Environmental Health division manager, is a registered environmental health specialist, and Jim Carey has been KCPH's air quality specialist since 2007.

Section 6 - Leveraged Funding (if applicable)

Dr. Addie Clark at the Oregon Institute of Technology has kindly offered to leverage her time at the estimated rate of $10,000 per year, or $50,000 over the life of this project. In addition, rebates and incentives at Energy Trust of Oregon range from $500 to $3,000 per home, or up to $900,000 in incentives for 300 households.

Section 7 - Budget

Description of the budget and estimated funding amounts for each work component/task.
The budget for this project is $16,901,238 and covers the aforementioned strategies and cost centers of (1) program and infrastructure costs, (2) personnel and staffing, and (3) additional costs. The majority of the project funds will be used for weatherization, heating systems replacements and school bus change outs. Additionally, some funding will be used for new sensor equipment to more effectively monitor PM, community firewood and an education in the community. Funding for personnel and staffing will support DEQ activities, including grant management, Klamath Falls staff responsible for implementing the grant activities, and contractor staff. Additional costs include fringe benefits and indirect costs as outlined below in more detail.

Description of the applicant's approach, procedure, and controls for ensuring that awarded grant funds will be expended in a timely and efficient manner.

DEQ follows all the requirements that are deemed necessary as a state government entity in the State of Oregon for applicable budgeting and procurement policies. DEQ has received numerous Federal grants over the years and has followed all applicable terms set by the Environmental Protection Agency.

Itemized costs.
Below is an overview of the line item costs associated with the project. Additional cost detail is included in the project budget materials accompanying this submission and follows the EPA direction on budget categories. DEQ has a negotiated 21.7% indirect cost rate with EPA and a copy of the approval is included in the attachments of the project submission.

- Personnel, Fringe Benefits and Travel ($456,641, 2.70% of total)
  - DEQ personnel: $278,140
  - Fringe Benefits: $123,341
  - Travel: $55,160
- Equipment ($35,000, 0.21% of total)
  - Ceilometer $35,000
- Supplies ($11,975, 0.07% of total)
- Other ($16,310,501, 96.5% of total)
  - Other Agency Services $51,489
  - Program Specific Items – 6 SensORs (PM Monitoring Equipment) and related supplies $27,000
  - Sub Award to Klamath County Public Health – grant administration $1,109,622
  - Klamath County Public Health Sub Award – woodstove change outs and weatherization $2,590,000
  - Klamath County Public Health Sub Award to Oregon Institute of Technology – On road mobile emissions reduction study $131,105
  - Klamath County Public Health Sub Award to Basin Transportation Services – Feasibility study and free public transportation on red and yellow days $131,285
  - Sub Award to Klamath Falls School District – diesel school bus replacements (20 busses x $130,000) and garage extension ($50,000) $2,650,000
  - Sub Award to Klamath County School District – diesel school bus replacements (72 buses x $130,00) $9,360,000
  - Sub Award to Oregon Child Development Coalition – diesel school bus replacements (2 buses x $130,000) $260,000
- Indirect Cost ($87,121, 0.52% of total)
  - DEQ has a federally negotiated Indirect Cost Rate of 21.7%

Budget Detail

I	**Personnel - DEQ**					
	Air Quality Planning Manager		.10 FTE	5 years	$23,981	
	Natural Resource Specialist 4 –Eastern Region		.20 FTE	5 years	$37,253	
	Natural Resource Specialist 4 – Air Quality Planning Staff		.20 FTE	5 years	$37,253	
	Operation and Policy Analyst 3 – Air Quality Budget Analyst		.10 FTE	5 years	$18,629	
	Natural Resource Specialist 4 – Laboratory Project Manager		.20 FTE	5 years	$37,253	
	Natural Resource Specialist 3 – Laboratory SensOR Specialist		.20 FTE	5 years	$32,290	
	Natural Resource Specialist 2 – Laboratory SensOR Construction		.25 FTE	5 years	$34,974	
	Natural Resource Specialist 3 – Laboratory Community Technical Support		.10 FTE	5 years	$16,145	
	Natural Resource Specialist 3 – Laboratory Data Analysis		.25 FTE	5 years	$40,362	
	Total DEQ Personnel					**$278,140**
II	**Fringe Benefits**					
	Total Fringe Benefits					**$123,341**
III	**Travel**					
	DEQ program staff and management site visits to Klamath Falls			$28,610		
	DEQ staff (3) travel to EPA RWH meetings			$26,550		
	Total DEQ Travel					**$55,160**
IV	**Equipment**					
	Ceilometer	1	$35,000/ea	$35,000		
	Total DEQ Equipment					**$35,000**
V	**Supplies**					
	Total DEQ Supplies					**$11,975**
V1	**Other Services**					
	Employee Training			$3,629		
	Telecommunications			$3,427		
	Data Processing			$1,613		

	Facilities Rental			$30,038		
	Fuels & Utilities			$363		
	Facility Maintenance			$323		
	Other Services			$12,096		
	Agency Program Related Svcs & Supp 6 SensORs Units and Additional supplies for SensORs (tripods, solar panels or extension cords, digital display)			$27,000		
	Sub Award – Payment to Other Government Services Sub Award broken down as follows :			$16,232,012		
	Sub Award to **Klamath County Public Health** – direct costs associated with grant administration				$1,109,622	
	Klamath County Public Health Sub Award to **South Coast Economic Development District**					
	Woodstove Change Outs	300	$5,000/ea	$1,500,000		
	Home Weatherization	300	$2,500/ea	$750,000		
	Rebates	50	$900/ea	$45,000		
	Inspections			$45,000		
	Project management			$150,000		
	Overhead/Indirect			$100,000		
	Sub Award to SCOEDD Total				$2,590,000	
	Klamath County Public Health Sub Award to **Oregon Institute of Technology**					
	PI – Dr. Addie Clark	5 yrs	$10,000/year	$50,000		
	Student Worker (3 h/wk * 30 wks / y x 5 y) + Oregon Tech 50% F&A	450 h	$15/hour	$10,125		
	Monitor	1	$4,505	$4,505		
	Cloud/Data Service for Monitor	5 yrs	$295/year	$1,475		
	HH Wood Heating and Use Survey			$65,000		
	Sub Award to Oregon Institute of Technology				$131,105	
	Klamath County Public Health Sub Award to **Basin Transportation Services**					
	Feasibility Study			$50,000		
	Free Public Transportation on Red and Yellow Days			$81,285		
	Sub-award to Basin Transportation Services				$ 131,285	
	DEQ Sub Award to **Klamath Falls School District** – diesel school bus replacements garage extension ($50,000)					
	School Bus Replacements	20 buses	$130,000/ea	$2,600,000		
	Garage Extension			$50,000		
	Sub Award to Klamath Falls School District				$2,650,000	
	DEQ Sub Award to **Klamath County School District** – diesel school bus replacements	72 buses	$130,000/ea		$9,360,000	
	DEQ Sub Award to OCDC – Migrant Services – diesel school bus replacement	2 buses	$130,000/ea		$260,000	
	Total Other Services					**$16,310,501**
VII	**Indirect**					
	DEQ Federally Negotiated Rate of 21.7% of Personnel and Fringe		21.7%			
	Total Indirect					**$87,121**
	TOTAL					**$16,901,238**

Section 8 - Attachments

1. Emissions Inventories
2. Emissions Reduction Calculations
3. Biographical sketches
4. Leveraged Funds Cost Commitment Letter & Partnership Letters